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FOREST INSECT INVESTIGATIONS

ENGELMANN SPRUCE BEETLE INFESTATION

WHITE RIVER NATIONAL FOREST

1944

By

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FOREST INSECT
LABORATORY

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During September 1944, a survey was made of the White River National Forest to obtain information on the extent and intensity of an epidemic infestation of the Engelmann spruce beetle in the spruce stands. The survey was made by the writer and Calvin Massey, who assisted in taking much of the data.

Active infestations of the Engelmann spruce beetle have been present on this Forest from time to time since the earliest records. The last major outbreak occurred 40 to 60 years ago. Since that time investigators have described the infestation as being in a "heavy endemic stage," meaning that an appreciable number of trees were being killed over what one would normally expect. From this information we can deduct there was a high population of these insects in the forest; the stage was set for an epidemic and needed only something to give it a start.

In June 1939 a wind-storm of exceptional velocity swept through many of the forests of the Western Slope and continued for two days. Thousands of trees were blown down, especially along the edges of mesa type country and on exposed sites. Although concrete evidence is lacking, there is reason to believe that the wind-thrown trees supplied an abundance of non-resistant material in which the Engelmann spruce beetle developed in enormous numbers during the period 1939 to 1942.*

By the time the seriousness of the condition was detected in 1942, the epidemic was considered too extensive for control measures to be feasible. An examination of all the known areas of infestation in 1943 revealed that the number of insect-killed trees had increased to an alarming extent. The infestation was then thought to be confined to an area west and south of Blair Mountain with only scattered groups of insect attacked trees to the east. Little hope was held for the heavily stocked stands that remained except to salvage as much of it as possible.

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*Wind-falls provide host material over a much longer period than fire-killed timber, cull logs, and the like because they often remain in a semi-live state due to the fact that some of their roots often remain embedded in the soil and continue to provide moisture long after the tree has fallen. Successive attacks from insect broods can therefore increase in a few years to such a population that normal tree resistance is overcome by numbers of attacks and an outbreak is the result.

In order to evaluate the extent of the damage to the forest and to determine the extent and trend of the infestation, the survey was made of representative parts of the entire forest during the past season. Although the work was limited in scope because of the lack of funds and men, it is thought that a fairly good representation of the forest as a whole was obtained.

The data taken are divided into the five working circles. There is reason to question some of the estimates because the samples taken were small. However, the infestation was found to be relatively high on all areas, which permits a greater accuracy in smaller samples. The estimates presented are the best obtainable under the circumstances.

Volume-loss estimates were obtained by recording basal areas, breast high, of all insect-killed and green Engelmann spruce 8 inches D.B.H. and over on 10th acre plots. Basal areas of the attacked and dead trees were then expressed as a percentage of the total basal area on the plots. This percentage of loss was applied to volume estimates supplied by the Office of Timber Management. The estimated loss by volume and percentages by periods during the past 5 years are shown in table 1.

Loss estimates for the years 1940, 1941, and 1942 are grouped because these older insect-killed trees could not be identified by years. It will also be noted that the percentage of loss for each period is shown as the percentage of the 1939 stand infested in that particular period. Had it been expressed as the loss to the residual stand the percentages for 1943 and 1944 would have been much higher.

Table 1 losses for the White River Forest for the past 5 years exceed 1 3/4 billion board feet. This is felt to be somewhat conservative although substantially correct. The writer's opinion of the data given for the working circles is: Colorado River and White River, the data is representative; Williams River and Bear River, the loss is probably not as severe as shown; Dotsero is thought to be underestimated. Based on past experience in estimating bark beetle caused losses, the total loss figures in the working circles can be expected to vary from accuracy by about 20 percent.

When applying the losses given in the above table, timber-sale men and operators are likely to wonder what the estimates mean in regard to the operable stands. Losses have occurred in about the same proportion in operable stands and in inoperable stands. Table 2 will show how the losses may be applied.

Another useful way of showing losses is in the number of infested trees per acre. Insect-killed trees per acre or percentage of stems killed are not comparable to percentage of volume lost because the Engelmann spruce beetle prefers the larger trees. Larger trees are taken as long as they last, then smaller diameters are attacked.

Table 3 will show the infested trees per acre and table 4 the total trees estimated to have been killed during the current outbreak. There is also included, for comparative purposes, an estimate of the number of green trees in 1939 and those remaining after the attack period in 1944. In tables 3 and 4 the data were obtained from counts of green, insect-killed, and infested trees on 588 - 10th acre plots in addition to 251 plots on which more complete data were taken. All Engelmann spruce 8 inches D.B.H. and over were recorded.

During the early stages and extending through the peak of an epidemic the Engelmann spruce beetle seems to select the large mature trees. As the supply of this host material diminishes, the beetle attacks smaller trees. This trend may be seen in the chart, B, Fig. 1, where a much higher percentage of the larger diameters were attacked by the spruce beetle than the smaller diameters. Further study of the chart, A, will show that the 1944 attacks tended to occur in smaller diameter classes.

Speculation on the future of this infestation does not present a hopeful picture. Eventually, it will die out, probably from lack of host material. And it can be expected that some trees in all diameter classes will survive - more in the smaller diameters than in the larger, but a stocking at least, from which the forest can rebuild again.

Respectfully submitted,

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Approved by:

N. D. Wygant, Entomologist
In Charge

Table 1

Estimate of Engelmann Spruce Losses in M.B.M. 1940 to 1944 Inclusive
by Working Circles.1/

Working Circle	Acres of E.Spruce 2/	1939 M.B.M. 3/	1940-42 Inclusive: M.B.M.	Percentage	1943: M.B.M.	Percentage	1944: M.B.M.	Percentage	Total 1940-44: M.B.M.	Percentage
Bear River	31,485	298,304	20,881	7%	17,898	6%	23,864	8%	62,643	21%
Colorado River	54,856	449,073	107,777	24%	116,759	26%	161,666	36%	386,202	86%
Dotsero	41,366	386,730	11,602	3%	11,602	3%	46,407	12%	69,611	18%
White River	86,005	1,273,310	254,662	20%	165,530	13%	445,658	35%	865,850	68%
Williams River	50,295	525,456	115,600	22%	42,036	8%	241,710	46%	399,346	76%
Total	264,007	2,932,873	510,522	17.4%	353,825	12.1%	919,305	31.3%	1,783,652	60.8%

1/ Based on 251 plots.
2/ Rocky Mountain Forest and Range Experiment Station. Some Forest Statistics for Colorado, Wyoming and South Dakota. E. M. Hornibrook 3/8/43.
3/ Timber Management, Timber Estimates Aug. 15, 1944 (includes volume killed by the Engelmann spruce beetle 1940-44).

Table 2. Estimate of Volume of Engelmann Spruce Killed by the Engelmann Spruce Beetle 1940 to 1944 by Operable and Inoperable Stands.

Working Circle	Operable		Inoperable	
	1939 Vol.M.B.M.	1940-1945 Loss in M.B.M.	1939 Vol.M.B.M.	1940-1945 Loss in M.B.M.
Bear River	266,053	55,871	32,251	6,773
Colorado River	178,126	153,188	270,947	233,014
Dotsero	217,143	39,085	169,587	30,525
White River	606,234	412,239	667,076	453,611
Williams River	414,471	314,998	110,985	84,348
Total	1,682,027	975,381	1,250,846	808,271

Table 3. Estimated Number of Trees Killed per Acre, 1940 to 1944 Inclusive.

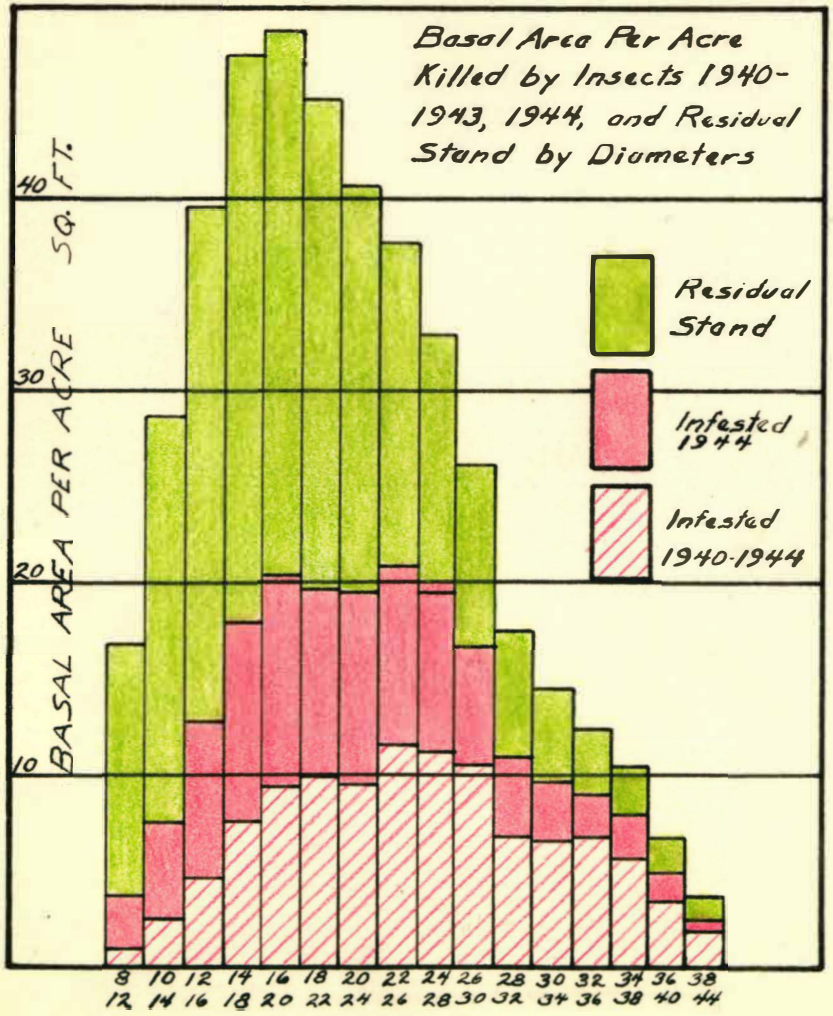
Working Circle	No.of Green Stems-1939	Number Trees Killed Per Acre				Percentage Killed 1940-44
		1940-42	1943	1944	Total 1940-44	
Bear River	118.48	6.95	3.90	6.95	17.80	13%
Colorado River	17.08	7.54	5.83	16.98	30.35	64%
Dotsero	55.33	3.13	.80	4.00	7.93	13%
White River	49.88	6.06	2.53	12.23	20.82	30%
Williams River	34.25	16.25	5.25	42.75	64.25	65%
Average	44.08	6.79	3.99	13.67	24.45	35.70%

Table 4. Estimated Number of Trees Killed by Working Circles, 1940 to 1944 Inclusive 1/.

Working Circle	Acres Spruce	No. Green Stems 1939	Number of Trees Killed				Green Stems 1944
			1940-41-42	1943	1944	Total	
Bear River	31,485	4,290,776	218,821	122,791	218,821	560,433	3,730,343
Colorado River	54,856	2,601,819	413,614	319,810	931,455	1,664,879	936,940
Dotsero	41,366	2,616,813	129,475	33,093	165,464	328,032	2,288,781
White River	86,005	6,080,553	521,190	217,593	1,051,841	1,790,624	4,289,929
Williams River	50,295	4,954,058	817,294	264,049	2,150,111	3,231,454	1,722,604
Total	264,007	20,544,019	2,100,394	957,336	4,517,692	7,575,422	12,968,597

1/ Based on 839 plots.

ENGELMANN SPRUCE BEETLE INFESTATION
WHITE RIVER NAT. FOR.
1940 - 1944


Basal Area Per Acre Killed by Insects 1940-1943, 1944, and Residual Stand by Diameters
BASAL AREA PER ACRE SQ. FT.
40
30
20
10
Residual Stand
Infested 1944
Infested 1940-1944
8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38
12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 44
DIAMETERS
A

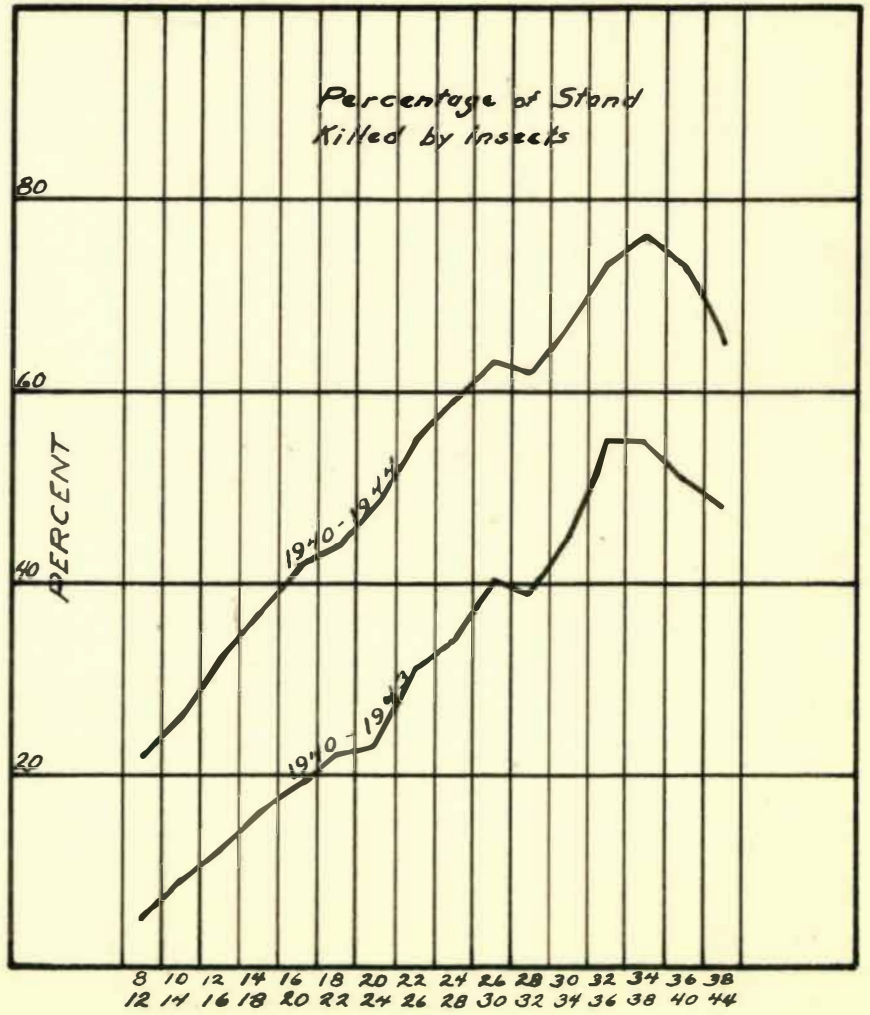


FIGURE 1